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EXAMINER	
PURINTON, BROOKE J	

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2881	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/564,131	ROSENBERG ET AL.	
	Examiner	Art Unit	
	Brooke Purinton	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 June 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32,35-42,44 and 45* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32,35-42,44 and 45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 December 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 2, 7, 8, 13, 14, 23, 24, 35, 36, 38, 39, and 44 are objected to because of the following informalities: improper antecedent basis, "relationships" have not been amended to become "distances". For the purposes of examination, examiner will read it as likewise substituted in claims 1, 15, 37 and 42. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 7, 8, 15-18, 20-24, 35-40, 42, and 44 are rejected under 35 U.S.C. 102(e) as being anticipated by Kochi et al. (USPAPN 2002/0179812).

Regarding Claim 1, Kochi et al. teach a method for determining a cross sectional dimension (a width or height on a substrate) of a measured structural element (specimen 9) having a sub-micron cross section, the cross sectional dimension defining an intermediate section of the measures structural element that is located between first and second traverse sections of the measured structural element (Figure 11, part s310 and page 2, paragraph 14, between the reference marks), the method comprising the steps of: scanning while an inspection tool is in a first tilt state, a first portion of a reference structural element and at least the first traverse section of the measured structural element, to determine a first distance between a certain point of the reference structural element and the first traverse section (Figure 11, part s316); scanning while the inspection tool is in a second tilt state, a second portion of a reference structural element and at least the second traverse section of the measured structural element, to determine a second distance between a certain point of the reference structural element and the second traverse section (Figure 11, part s316 and page 1, paragraph 11 "detecting data three dimensionally means that the electron beam 7 is irradiated to the specimen holder 3 at different, first and second angles and first and second data of the specimen 9 are detected with the electron beam detecting section 4,"); and determining the cross sectional dimension of the intermediate section of the measured structural element in response

to the first and second distances (page 1, paragraph 13, "shape measuring section 32 for measuring the shape of the specimen 9 on the basis of the data corrected with the data correcting section 31").

Regarding Claim 15, Kochi et al. teach a method for determining a cross sectional dimension of a measured structural element having a sub-micron cross section, the cross sectional dimension defining an intermediate section of the measured structural element that is located between first and second traverse sections of the measured structural element, the method comprising the steps of: scanning while an inspection tool is in a first tilt state, at least a first point of a first reference structural element and at least the first traverse section of the measured structural element, to determine a first distance between the first reference structural element and the first traverse section (Figure 11, part s316); scanning while the inspection tool is in a second tilt state, at least a second point of a second reference structural element and at least the second traverse section of the measured structural element, to determine a second distance between the second reference structural element and the second traverse section (Figure 11, part s316 and page 1, paragraph 11); and determining the cross sectional dimension of the intermediate section of the measured structural element in response to the first and second distances (page 1, paragraph 13, "shape measuring section 32 for measuring the shape of the specimen 9 on the basis of the data corrected with the data correcting section 31".

Regarding Claim 37, Kochi et al. teach a method for determining a cross sectional dimension of a measured structural element having a sub-micron cross section, the cross sectional dimension defining an intermediate section of the measured structural element that is located between first and second traverse sections of the measured structural element, the method comprising the steps of: scanning while an inspection tool is in a first tilt state, first portions of a set of reference structural elements (reference marks, plural [108]) and at least the first traverse section of the measured structural element, to determine a first set of distances between first certain points of reference structural elements of the set of reference structural elements and the first traverse section (Figure 11, part s316); scanning, while the inspection tool is in a second tilt state, second portions of the set of reference structural elements and at least the second traverse section of the measured structural element, to determine a second set of distances between second certain points of reference structural elements of the set of reference structural elements and the second traverse section (Figure 11, part s316); and determining cross sectional dimension of the intermediate section of the measured structural element in response to the first and second sets of distances (page 1, paragraph 13).

Regarding Claim 42, Kochi et al. teach the system for determining a cross sectional dimension of a structural element having a sub-micron cross section, the cross sectional dimension defining an intermediate section that is located between a first and a second traverse sections of the structural element, the system comprising: means for directing an electron beam towards an inspected object including the structural element so as to scan, at a first tilt state, a reference structural element and at least the first traverse section of the structural element, and to scan at a second tilt state, the reference

structural element and at least the second traverse section of the structural element (Figure 3, part 5a) at least one detector that is positioned so as to detect electrons emitted from the structural element as a result of an interaction with the electron beam (Figure 3, part 4); and a processor, coupled to the at least one detector and to the directing means so as to process detection signals received from the at least one detector and to (Figure 3, part 20): determine a first distance between a certain point of the reference structural element and the first traverse section (Figure 11, s322 and [109], [110]); determine a second distance between the certain point of the reference structural element and the second traverse section (Figure 11, part s322 and [109], [110]); and determine the cross sectional dimension of the measured intermediate section of the structural element in response to the first and second distances (Figure 11, part s330).

Claim 2- Kochi et al. teach a method of claim 1 wherein the first distance is a distance between the certain point of the reference structural element and a first edge of the measured structural element (Figures 1a-2b, showing the d12 and d23 and corrected deviation after angle images, used to create figure 2b).

Claim 3- Kochi et al. teach a method of claim 2 wherein the first edge of the measured structural element and the certain point of the reference structural element are substantially located on a same plane (Figure 4c, point where first edge meets reference structural element 40).

Claim 4 – Kochi et al. teach a method of claim 1 wherein a height of the certain point of the reference structural element is much smaller than a height of the measured structural element (Figure 4c, reference template 40 much smaller than 40 a/b measured structural element).

Claim 5- Kochi et al. teach a method of claim 1 further comprising a preliminary step of generating the reference structural element at a vicinity of the measured structural element (Figure 11, s310-s316).

Claim 7/23/35 – Kochi et al. teach a method of claim 1/15/25 and further teach wherein at least one additional reference structural element is provided at a vicinity of the reference structural element and wherein the steps of scanning further comprise scanning the at least one additional reference structural element to provide a third distance, in addition to the first and second distances, between the at least one additional reference structural element and a traverse section of the measured structural element (reference marks [108], where all are scanned).

Claim 8/24/36 - Kochi et al. teach the method of claim 7/23/35, wherein the step of determining is further responsive to the third distance ([109] "calculates... from the reference marks detected").

Claim 16/40- Kochi et al. teach the method of claim 15/37, wherein the reference structural element is positioned on both sides of the measured structural element (Figure 4).

Claim 17- Kochi et al. teach the method of claim 15 further comprising a step of measuring a distance between the first and second points ([64]).

Claim 18- Kochi et al. teach the method of claim 17 wherein the measured structural element is positioned between the first and second reference structural elements and wherein the step of measuring the distance comprises performing at least one scan of the first and second points and the measured structural element (Figure 4, Figure 11)

Claim 20- Kochi et al. teach method of claim 15 wherein the structural element is line that has a top section and two substantially opposing sidewalls (semiconductor pattern [58]).

Claim 21 - Kochi et al. teach the method of claim 15 wherein the structural element is a contact (semiconductor pattern [58]).

Claim 22 – Takane et al. teach the method of claim 15 wherein the structural element is a recess (semiconductor pattern [58]).

Claim 38 – Kochi et al. teach the method of claim 37 wherein the step of determining comprises statistical processing of the distances of the first set to provide a first distance (pages 7-9, mathematical steps, relating image processing, parameter calculating to provide distances among points).

Claim 39-Kochi et al. teach the method of claim 37 wherein the step of determining comprises statistical processing of the distances of the second set to provide a second distance (pages 7-9, mathematical steps, relating image processing, parameter calculating to provide distances among points).

Claim 44- Kochi et al. teach the system of claim 42 wherein the processor is capable of determining the cross sectional dimension in response to additional distances between the measured element and additional reference structural elements (shape measuring section 32, page 2, paragraph 23).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6, 9-14, 26 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kochi et al. (USPAPN 2002/0179812) as applied to claims above and further in view of Takane et al. (USPAPN 2003/0010914).

Claim 6 – Kochi et al. teach a method according to claim 1.

They fail to teach wherein during the first tilt stage a measurement angle defined between a measured object that includes the measured structural element and an electron beam that scans the measured structural element is substantially ninety degrees.

Takane et al. teach a first scan of an electron beam that scans the measured structural element at a 90 degree angle (Figure 3 and Figure 11).

It is known in the art to scan at ninety degrees and will still give information about the distance between measured and reference structural element, therefore, it would be obvious to try. Scanning a beam at a 90 degree angle to the reference structural element would yield the predictable results of garnering more information about the specimen and any measured structural elements.

Claim 9/25/45 – Kochi et al. teach the method of Claim 7/15/42.

Kochi et al. are silent on determining whether to perform additional scanning.

Takane et al. teach wherein after scanning, while the inspection tool is in the first tilt state determining whether to perform additional scanning (Page 5, paragraphs 72-73 and Figure 10, part 1004).

Modification would have entailed using the technique of Takane et al. in the method of Kochi et al. to stop scanning after any scan period.

It would have been obvious to one of ordinary skill in the art at the time of the invention to make such a medication since it would enable an operator to stop the scan whenever necessary(for instance, if the electron beam was malfunctioning, if the focus was off, if there was the wrong wafer in the holder, if the reference structural elements were not made or if the first scan provided all the information needed) without wasting time while waiting for all the scans at various tilt angles to be completed.

Claim 10-Kochi et al. and Takane et al. teach the method of claim 9 wherein performing the scanning, Takane further teaches while the inspection tool is in the second tilt state, is in response to determining a feature of the first traverse section (Figure 10, part 1004).

Claim 11 Kochi et al. and Takane et al. teach the method of claim 10, Takane further teaches wherein the feature is an estimated width or an estimated orientation of the first traverse section ("protrusion/depression" (1,9)).

Claim 12- Kochi et al. and Takane et al. teach the method of claim 11, Takane et al. further teach wherein the orientation is estimated by comparing detection signals generated as a result of a scan of the first traverse section and detection signals generated as a result of at least one scan of another traverse section of known width (page 1, paragraph 8).

Claim 13- Kochi et al. and Takane et al. teach the method of claim 9, Kochi et al. further teach wherein at least one additional reference structural element is provided at a vicinity of the reference structural element and wherein the steps of scanning further comprise scanning the at least one additional reference structural element to provide a third distance, in addition to the first and second distances, between the at least one additional reference structural element and a traverse section of the measured structural element ([108-109]).

Claim 14- Kochi et al. and Takane et al. teach the method of claim 13.

In the combination of the two inventions, it would have been obvious wherein the step of determining is further responsive to the at least one additional third distance, for the same reasons as given in Claim 9.

Claim 26 – Kochi et al. teach the method of claim 25.

They fail to explicitly teach wherein the scanning, while the inspection tool is in the first tilt state, comprises scanning with an electron beam that is substantially perpendicular to a measured object that includes the measured structural element

Takane et al. teach wherein the scanning, while the inspection tool is in the first tilt state, comprises scanning with an electron beam that is substantially perpendicular to a measured object that includes the measured structural element (Figures 3 and Figure 10, page 1, paragraph 8).

It is known in the art to scan at ninety degrees and will still give information about the distance between measured and reference structural element, therefore, it would be obvious to try. Scanning a beam at a 90 degree angle to the reference structural element would yield the predictable results of garnering more information about the specimen and any measured structural elements.

Claim 28 – Kochi et al. teach the method of claim 25.

They fail to explicitly teach wherein the determination of whether additional scanning is required is responsive to an estimated orientation of a traverse section (Figure 10, depression/protrusion determination step 1004/1008).

Takane et al. teach wherein the determination of whether additional scanning is required is responsive to an estimated orientation of a traverse section (Figure 10, depression/protrusion determination step 1004/1008).

Modification would have entailed using the technique of Takane et al. in the method of Kochi et al. to stop scanning after any scan period dependent on the orientation of a traverse section.

It would have been obvious to one of ordinary skill in the art at the time of the invention to make such a medication since it would enable an operator to stop the scan whenever necessary(for instance, if the electron beam was malfunctioning, if the focus was off, if there was the wrong wafer in the holder, if the reference structural elements were not made or if the first scan provided all the information needed) without wasting time while waiting for all the scans at various tilt angles to be completed. Orientation could detail whether the wafer being scanned has a defect that renders it unusable in the future, and thus, pointless to examine now, or for various other reasons.

Claims 19, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kochi et al.

Claim 19- Kochi et al. teach the method of claim 18.

He fails to teach wherein the at least one scan comprises preventing the electron beam to illuminate the measured structural element.

It would have been obvious to one of ordinary skill to skip the measured structural element if the element had a width that was excessively wide and therefore not waste time observing it, since the

objective in that case might have been to simply understand if it was protruding or recessing into the reference structural element. Not illuminating the measured structural element would have yielded the predictable results of saving time when coordinates of the traverse sections are already known.

Claim 41 – Kochi et al. teach the method of claim 37, wherein the set of reference structural elements is positioned at a side of the measured structural element (Figure 4a,4b and [105]). It would have been obvious to one of ordinary skill to use these reference points created in any way necessary to best complete the scanning and etection that goes along with it "to judge whether the position and number of the feature points are sufficient ... after dividing the image into segments," [105] meaning that the reference mark position is a design choice based need and/or knowledge of surface to be judged. Therefore, it would be obvious to tailor the reference elements to what was needed, and placing the reference structural elements on one side would be an implicit embodiment.

Claims 27 and 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kochi et al. as applied to claims above and further in view of Muckenhirn (USPAPN 2003/0168594)

Claims 27 and 29-32 are rendered obvious by the fact that Kochi et al. teach the method of claim 25, further teaching wherein the determination of whether to perform additional scans is responsive to an estimated orientation of a traverse section.

Kochi et al. fail to teach wherein the determination of whether to additional scanning is required is responsive to an estimated width of a traverse section, cross sectional dimension, or a threshold including a maximum or minimum width needed.

Muckenhirn teaches a surface analyzing system wherein the determination of whether to perform additional scans is responsive to an estimated width of a traverse section, cross sectional feature, or a threshold including a maximum or minimum width needed (Figure 4, part 416).

One of ordinary skill in the art could have pursued the width dependent observation method of Muckenhirn in order to avoid wasting time or slowing down inspection processes with for example, measured structural elements that are too wide to move along in a manufacturing base, or protrusions, perhaps wires, that are too thin to be operable (Muckenhirn, page 1, paragraph 3).

There would have been a reasonable expectation of success since the observational data garnered from single tilt and multi-tilt images would have allowed a realization of the important characteristics of the wafer, and therefore, the capability to stop processing or continue processing as necessary if the semiconductor characteristics are unsuitable.

Response to Arguments

Applicant's arguments filed 6/25/2009 regarding the reference Kochi et al. have been fully considered but they are not persuasive.

Applicant states that "Kochi fails to disclose measurement of any kind"

In the explanation of Kochi, examiner pointed out shape measurement section, discussed on page 1, paragraph 13, where it measures the shape of the specimen. Therefore, Kochi definitely teaches a measurement.

Applicant states that "an alignment is not analogous to a determination of a distance between two points" and that "Kochi merely teaches the manipulation of images with regard to a common reference point in order to generate a stereoscopic image" which is done "without making any determination of distances."

Let's examine the invention of Kochi with regards to distances measured:

Kochi uses an electron beam to irradiate the specimen at first and second angles to collect "first and second data of the specimen" paragraph [11] where the specimen has reference marks [14].

1. Examiner takes the stance that the first and second data has to have distances involved between the observed points.

Then, Kochi corrects the data gained from those two scans to rectify the distortion of image data [12].

This is to use for three dimensional measurements or for forming three dimensional images [12].

2. Examiner takes the stance that three dimensional measurements contain two dimensional measurements within them, and the third dimension is another layer of information on top of the two dimensional information.

The apparatus further comprises a shape measuring section, to measure the shape of the specimen [13].

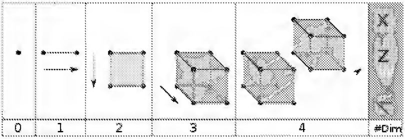
3. Examiner takes the stance that this is an implicit teaching of measuring the cross sectional dimension of the intermediate section, since that would be a part of the shape of the specimen.

To further explain the examiners stances:

1. The collection of first and second data is done by electron beams scanning the sample by first and second tilt states. These create first and second images [53]. Images are necessarily going to have a coordinate grid in order to properly represent the image. Therefore, the image will have the distance between the marks on the image laid out implicitly in the image itself. This is because it will be an image which contains the at least two reference marks as well as the space without the marks which is in between the marks. The electron beam will have scanned all of the image, in order to fulfill the primary

goal of correcting the three dimensional image. Therefore, taking the image of the section, means determining the distance of the section, and the parts between two features.

2. The dimensions are diagrammed below:



A diagram showing the first four spatial dimensions.

Each dimension has the information of the previous dimension (at least one point in the first dimension, at least one line in the second dimension, etc). Thus, the three dimensional cube also has the dimensions of the two dimensional square shown. Extrapolating this model, the three dimensional model of Kochi will have the two dimensional information of the specimen as well, including the shape of the cross sectional dimension of the intermediate section which is examined.

3. For the same argument above, the shape measuring section is going to be measuring the shape of the specimen, which will include not just the height above the z=0 surface in the case of a protrusion, but also how long a protrusion will extend before the surface again returns to a z=0 coordinate.

Therefore, in regards to the applicant's original arguments, examiner believes that Kochi does not merely teach the alignment and manipulations of images, and that implicit in his method is the determination of distances of the specimen from either the reference points made, or the marks that are already present on the surface. This seems to incorporate all the steps of applicants invention, plus the additional feature of creation of a three dimensional image.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brooke Purinton whose telephone number is 571.270.5384. The examiner can normally be reached on Monday - Friday 7h30-5h00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on 571.272.2293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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